cribed to them by Treub is a correct one. Their future examination is likely to be productive of much interest.—CONWAY MACMILLAN.

A contribution to the knowledge of nuclear mechanics in the sexual and other reproductive cells of plants.[2]

The paper of Guignard here noted is remarkable not only for the brilliant series of researches which it chronicles but also for the able review of a mass of literature which is not yet very well known to any except a small coterie of specialists. Reference is made to the memoirs on the subject of the intimate phenomena which are now known to go on in both plant and animal cells in process of division, and have been called the spermatokinetic and ookinetic processes. Guignard gives a résumé of the important conclusions which have been reached in both the plant and animal world and adds some luminous suggestions concerning the physical basis of heredity. A number of the facts brought forward in this paper are not altogether new, having before appeared in recent works of the same author, but the generalizations and many of the illustrative examples are not hitherto published. Guignard has been studying the development of pollen and embryo-sacs—particularly in *Lilium martagon*—and has followed out in great detail the complicated and yet altogether orderly nuclear phenomena which invariably accompany the act of reproduction and are part of its very essence. Without the aid of any very extraordinary technique or the necessity of unusually difficult manipulations he has contributed a number of extremely interesting observations along his line of work. Some of these may be briefly noted.

1. Just outside the nuclear membrane in all cells examined there are to be distinguished two small spheres of protoplasm —called by their discoverer "directive spheres." They are not easily stained by ordinary methods. These two spheres lie side by side in the resting nucleus but when the nucleus begins to divide they are seen to have a special position and function to perform. They separate and pass to opposite ends of the nucleus and form the astrocenters towards which the chromosomes slowly move and accomplish the division of

[2]Guignard: Nouv. études sur la fécondation, Ann. Sci. Nat. Botan., Ser. VII. XIV. pp. 163—288.

the colorable nuclear elements. While the division is in what is commonly called the "spindle" stage the astrocenters each divide and thus form at each end of the old nucleus a *pair* of directive spheres. With the development of the nuclear membranes in the two daughter-nuclei the spheres take up their normal positions and the process may be repeated as the divisions continue. It is this contribution to our knowledge of the morphology of the astrocenter that counted so much for Guignard in the assignment of the Prix Bordin, just awarded him by the French Academy.

2. In mother-cells of spores the nuclear plate consists of twenty-four chromosomes but in the spores themselves and in sexual cells the number is only twelve. The sexual act then consists in the *addition of a number of chromosomes, that brings the number up to the normal again.*

3. These chromosomes are purely passive and their union is a function of the directive spheres which accompany them just outside the nuclear membrane which encloses the chromosomes themselves. This is brought about as follows in L. martagon—the plant of particular study:

4. After the pollen tube has reached the egg-cell, which lies in the embryo-sac immediately behind the two synergidae, the male nucleus is seen to pass over to the egg-cell and take up a position beside it in such a way that the two directive spheres are in contact with each other. The two nuclei generally lie in the same horizontal plane but in rare cases one may lie above the other. The two spheres now slip out in pairs, one pair going to what will be one pole of the now almost mature segmentation nucleus and the other pair going to what will become the other pole. As the nuclear membranes, now in close contact, dissolve, the central portions of each pair of spheres (the centrosomes) become merged and a *single directive sphere lies at each pole of the segmentation nucleus*. These become the astrocenters for the segmentation nucleus. Since the male nucleus contains more easily stained chromatin than the female, Guignard was in many cases able to tell, by examination, which chromosomes in the segmentation nucleus had come from the male plant and which from the female. He found that after the absorption of the membranes lying between the two copulating nuclei and the formation of the plate in the segmentation nucleus the male

and female chromosomes were shifted about in such a way that some of both kinds were diverted to each pole.

5. The two most important theoretical considerations noted, are, first, that the nucleus can no longer be considered as taking the initiative in the work of cell-fusion but this must be given back to the protoplasm from which the directive spheres are formed. The nuclei are but passive parcels of hereditary substance transmitted from one cell to another and always under the dynamic control of the spheres. Second, the male and female sexual cells transmit the same number of chromosomes and thus indicate that they have an equivalent part in the heredity and that the view that the male is merely a stimulant or irritant under which the female nucleus takes on the character of a segmentation nucleus is not supported by the facts of morphology in the case in hand.

The article is given a fitting close by ten of those plates which are made nowhere but in Paris. In them one can follow with the greatest ease the investigations of the author and alone they constitute no mean addition to the literature of mitosis.—CONWAY MACMILLAN.

Burnt spots on leaves.[1]

It is a well known fact, that the green parts of plants, especially the leaves, may show local or partial decolorations, due to different factors. We do not speak of the decoloration which is generally referred to chlorosis or etiolation, but of the yellow, brown or perfectly black spots which are not uncommon upon the leaves of plants kept in greenhouses. Such spots may be due to parasitic animals or plants or to inorganic agents. In the last case they are characterized as "burnt spots." This disease has been recorded in literature long ago. Burnt spots have been attributed to several pathological changes, which, although they showed great similarity to those caused by a relatively high temperature, nevertheless originated from quite different factors.

One of the oldest theories to account for these, and as it seems the only acceptable one, was that which ascribed them to the common presence of air-bubbles in the glass used as cover for green-houses. The air-bubbles were supposed to have

[1] JÆNSSON BENGT: Om brænnflæckar paa væxtblad. Botaniska Notiser. Lund 1891. 30 pp. 2 colored plates.